DOCUMENT RESUME

ED 405 960 PS 025 085

AUTHOR Hanson, J. Robert
TITLE Metacognition: Strategies for 'Fourthought.'
PUB DATE Oct 96
NOTE 14p.; Paper presented at the Annual Conference and Exhibit of the National Middle School Association (23rd, Baltimore, MD, October 31-November 3, 1996).
PUB TYPE Speeches/Conference Papers (150) -- Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cognitive Processes; Cognitive Psychology; *Cognitive Style; Curriculum; Elementary Secondary Education; Learning Experience; Learning Processes; Learning Strategies; *Metacognition; Teaching Models
IDENTIFIERS Cognitive Models; Cognitive Preference; Jung (Carl G)

ABSTRACT

The brain's architecture serves as the basic model for theorizing about how the brain works. Current brain research confirms earlier suspicions that thoughtfulness has a great deal more complexity than the simplistic left/right distinctions of earlier research. This paper draws on the work of Carl Jung to propose the brain-psyche model as an interpretive tool to improve instruction. Curriculum goals based on this model (which delineates the intuitive-thinking, intuitive-feeling, sensing-thinking, and sensing-feeling learning styles) are provided. These include understanding critical thinking, hypothesizing, and concept development; and synthesis creativity, valuing, problem solving, and aesthetic judgment. The paper also presents some metacognitive principles for learning, including: (1) the brain is a quadrilateral performer and effective learning occurs when the student is challenged to respond on all levels; (2) learning involves the entire psyche, of which the body is a part; (3) learning content that has "meaning" requires the learner's verbalization; (4) learning academic content requires that the brain be simultaneously relaxed yet alert; (5) learning for recall requires patterning; (6) learning requires conscious self-management; (7) learning requires dealing with resistance; (8) learning is its own reward; (9) learning begins with the recognition of affect; (10) metacognitive capacity begins with self-knowing; and (11) learning is for the sake of self-discovery. (Contains 27 references.) (WJC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 405 960

Metacognition

Strategies for 'Fourthought'

by Dr. J. Robert Hanson

October, 1996

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
X This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
J.R. Hanson
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

J. ROBERT HANSON & ASSOCIATES
THE WHOLE CHILD PRESS
238 HALLOWELL ROAD
POWNAL, MAINE 04069

PS 025085

BEST COPY AVAILABLE

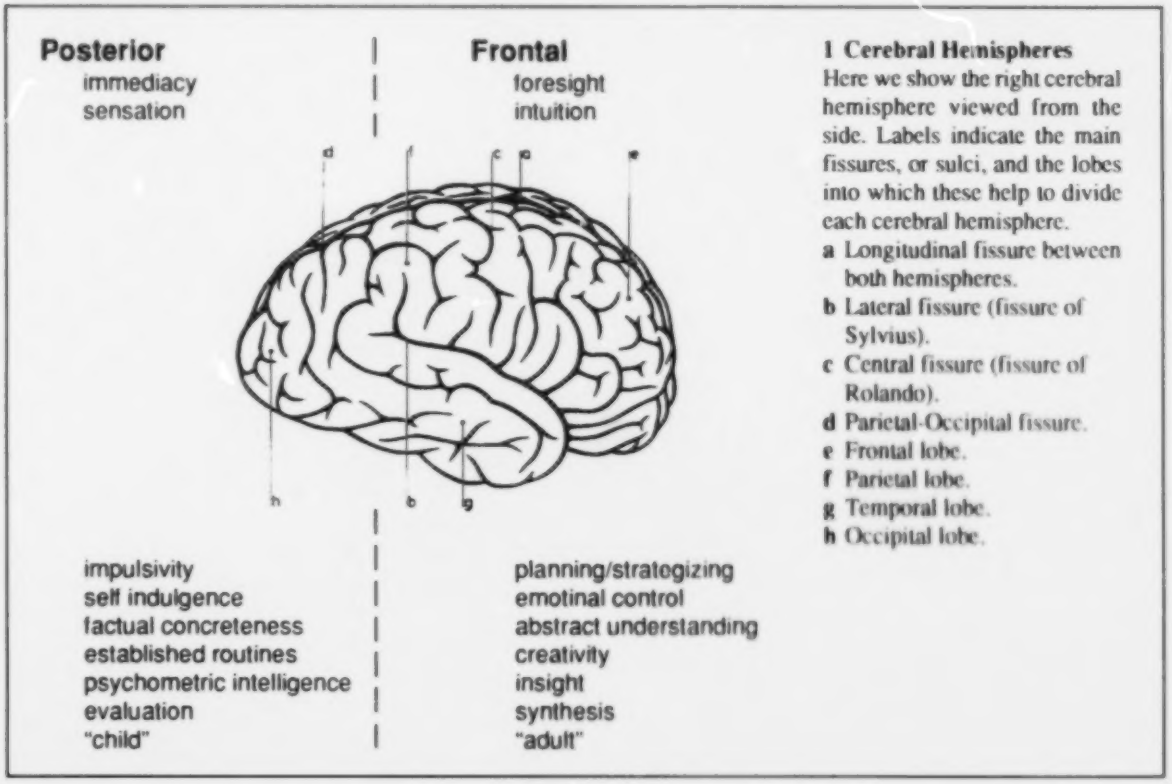
Introduction

The brain's architecture serves as our basic model for theorizing about how the brain works. Current brain research (Miller, 1988; Goodman, 1978) makes it clear that the most dramatic structural division of the brain is not the left/right hemispheric division, but rather, the front/rear latitudinal division. In effect, the operations of the neocortex can be better understood in terms of its fourfold operations. On top of the left/right hemispheric functions with which most educators are familiar [i.e., thinking versus feeling, language versus spatial organization, analysis versus synthesis, digital versus analogic, linear versus spatial and logical versus holistic] there are also the frontal/posterior distinctions of foresight versus immediacy, intuition versus sensation, planning versus impulsivity of response, emotional control versus self indulgence, abstract understanding versus factual concreteness, creativity versus established routine, insight versus psychometric intelligence, synthesis versus evaluation, and "adult" versus "child." Jacob Bronowski has called the frontal lobes the "organ of civilization." Intelligence theorists speak of two levels of intelligence: the A level (which IQ tests measure) is the concrete, factual, linear level and in terms of brain capacity is referred to as the lower level, i.e., essential in an anticipatory sense, but still subordinate to the B level (not, to date, measurable by IQ tests) which functions as both the center for emotional control and for foresight, synthesis, aesthetics, and personal awareness.

These new and essential distinctions confirm our earlier suspicions that thoughtfulness has a great deal more complexity than the simplistic left/right distinctions of earlier research.

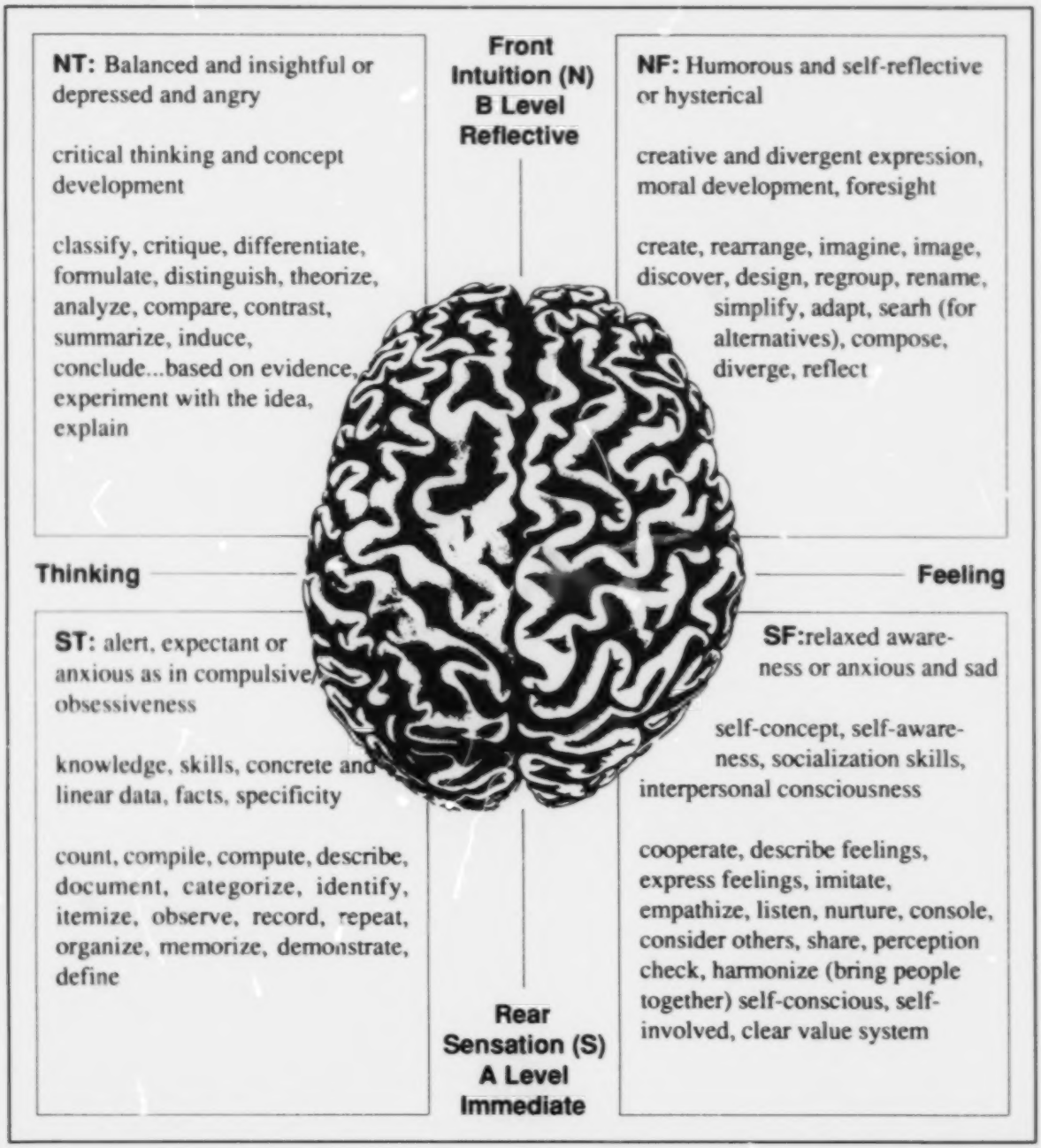
The new model, as a metaphor, might then more accurately look as follows:

Figure 1: The Cerebrum—Frontal versus Posterior Functions



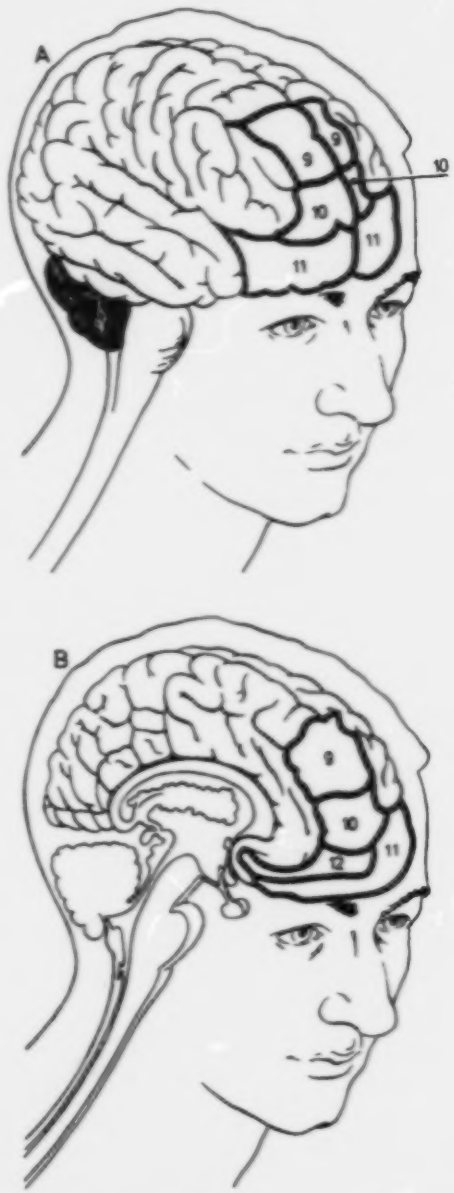
The brain is also far more complicated than frontal/posterior and left/right distinctions would suggest. While there are specific functions served by each of the quadrants, i.e., left and right frontal and left and right posterior, the quadrants, much like a holographic plate, also are cognizant of their own and of the other quadrants' functions. The frontal partnership is characterized by what Harold Sackheim calls "reciprocal inhibitory control," i.e., the two frontal lobes act as control devices for one another. The posterior lobes are in an even more dramatic relationship with one another since these lobes contain the left/right portions of our sensory mechanisms, i.e., the occipital, temporal and parietal functions.

Figure 2: Looking down from the top


NT: Balanced and insightful or depressed and angry
critical thinking and concept development
classify, critique, differentiate, formulate, distinguish, theorize, analyze, compare, contrast, summarize, induce, conclude...based on evidence, experiment with the idea, explain
Front Intuition (N) B Level Reflective
NF: Humorous and self-reflective or hysterical
creative and divergent expression, moral development, foresight
create, rearrange, imagine, image, discover, design, regroup, rename, simplify, adapt, searh (for alternatives), compose, diverge, reflect
Thinking
Feeling
ST: alert, expectant or anxious as in compulsive/ obsessiveness
knowledge, skills, concrete and linear data, facts, specificity
count, compile, compute, describe, document, categorize, identify, itemize, observe, record, repeat, organize, memorize, demonstrate, define
SF:relaxed awareness or anxious and sad
self-concept, self-awareness, socialization skills, interpersonal consciousness
cooperate, describe feelings, express feelings, imitate, empathize, listen, nurture, console, consider others, share, perception check, harmonize (bring people together) self-conscious, self-involved, clear value system
Rear Sensation (S) A Level Immediate

Both frontal and posterior lobes instantly (to the place of being almost simultaneous) communicate with one another, hence, the holographic notion that what remembered data is in one quadrant is simultaneously in the others. The metaphor suggests that the posterior lobes provide us with our multiple perceptions of both the outside and inside world, but that the frontal lobes determine what it means and how to control the emotional and consequently affective "charges" resulting from the perceptual messages. One final biological dimension must be mentioned. It is still another layer of the interdependencies which our metaphor identifies as the limbic system. The non-verbal messages of "emotion" tend to be sent from this set of organs to the neocortex for processing. The higher level intelligence of the frontal lobes "decides" how these messages can be verbalized and controlled. The lower level posterior lobes tell us what the emotional messages mean in terms of physical sensation, e.g., fear, satisfaction, anxiety, frustration, elation, respiration, etc. So when the brain is operating "normally" it is in fact a "whole brain," the parts all being instantaneously connected an interdependent. Developmental psychologists can chronicle the person's development from childhood to adolescence to adulthood. From a biological perspective it is the on-going movement from a posterior to a more developed frontal capacity.

Figure 3: Personality and the Frontal Cortex



1 The Prefrontal Cortex
The Brodmann areas 9 through 12 make up the prefrontal cortex, shown (A) on the complete human brain and on a median cross-section (B). The prefrontal cortex is responsible for an individual's responses to circumstances; these responses may range from despair, anxiety and dislike to ecstasy, optimism and delight. The prefrontal cortex is not involved with intellect, but with emotional response, damage or surgery affecting the area will tend to make a person more passive, with lesser extremes of emotional response.

Understanding Mind as Psyche

The mind is what the brain does. But mind is far more than reasoning capacity. Psyche, or mind, is a plural noun and includes three broad domains and a host of functions. Psyche, the Greek word for soul, includes the awareness of mind, body and spirit. Functionally it addresses sensation, intuition, thinking, feeling, and broad, often culturally influenced "attitudes" toward the world.

Exactly 70 years ago a Swiss psychiatrist, Carl Gustav Jung, gave the infant psychological

community its first clear picture of the psyche as sets of functions in various stages of development. This pioneering work, *Psychological Types* (1921), anticipated most of what current brain research is telling us. And, in fact, it appears that Jung's many layered metaphor is the psychological equivalent of the brain's quadrilateral organization.

Looking at the functions of personality as sets of polarities, i.e., intuition versus sensation and feeling versus thinking, Jung could describe a very basic psychological type as more sensing than intuiting, or more thinking than feeling. To these dimensions he added a modifier, i.e., introversion or extraversion. Jung's earliest formulations then identified eight basic types, one of the four functions modified by either an introverted or an extraverted orientation. In later years he theorized about combining a perception and a judgment function and postulated the model which follows in Figure 4.

What the brain biologists refer to as the frontal lobes orientation to reflection, foresight, aculturation, maturity and the capacity for emotional control is what Jung intended as the positively connoted meaning of introversion, i.e., the capacity to go "inward," to expand one's sense of self and to take the processing time necessary to be clear about what one values, i.e., to address the questions of meaning. The extraverted orientation is a more verbally and physically interactive orientation

"... for it is one's psychological type which from the outset determines and limits a person's judgment."

"One does not become enlightened by imagining figures of light, but by making the darkness conscious."

Carl Gustav Jung

Figure 4: Jung's Concept of Type

Intuition

NT: The intuitive-thinking (NT) learner prefers instruction that focuses on the meanings and relationships of data, on ideas, the interrelationship of ideas, and on how one can construct evidence for how things work. This learner wants to know why a things is so, to explain its working relationships, and to understand meanings. S/he relishes experimentation, looking for cause and effect, inferring relationships, and defending ideas. They like problems that require logic, analysis, reasoning, and that which can be defended based on external data. They generally are among the best students.

NF: The intuitive-feeling (NF) learner prefers instruction that allows for personal exploration of a subject or content of personal interest. This student brings, as does the SF, high levels of affective energy to learning tasks because of personal interest. The NF learner functions best in classrooms allowing personal discretion, new challenges, creative and imaginative approaches, involvement in many different kinds of tasks, creative and artistic expression, and new and unusual applications of existing knowledge to new and different situations. The NF tends to excesses of degree but is often among the brightest of students if recognized and properly channeled.

Thinking — **Feeling**

Judgment

ST: The sensing-thinking (ST) learner prefers instruction that focuses on facts, drill, recall, demonstration, and especially on the physical manipulation of tangible objects. This learner likes to know exactly what is expected, how s/he's doing at each moment, wants teacher/peer feedback on what's correct, feels best with right-wrong questions, enjoys doing things already mastered, relies on factual material and is usually a good worker.

SF: The sensing-feeling (SF) learner prefers instruction that focuses on personal values, interpersonal relationships, how learning relates to getting along better with one another, and demonstrations of empathy and support for one another. This learner likes to know how others feel and wants support and encouragement from teachers and peers. This learner functions best in verbally interactive situations where one can learn through discussion and personal sharing. This learner learns best when content has personal meaning.

Perception

Sensation

localized in the moment, always in the company of others, provisional, often exploratory without a sense of focus and highly energized physically. Extroversion, biologically, then tends to have a more posterior lobal orientation with its focus on immediacy, experience, interaction with others, and sensory dependencies.

One essential idea must be made clear instantly. No one, no person is just one type. All of us are all the functions and both the attitudes. Everyone has, therefore, the potential capacity to be "balanced," self actuating, or to use Jung's term, individuated. By the same token cultural influences and developed capacities do allow the aware observer to describe individual differences.

Jung's intention was never, ever, to come up with still another labeling system. Hence, interestingly, the purposes for "typing" was to "detype," or for "style" to destyling. What Jung meant was that to use psychological functions from a healing or educational perspective one had to think of the person's profile. The profile is like the metaphor of a camera taking a delayed action picture over a prolonged period of time showing both capacity and potential. In short, each type or style contains assets and liabilities, strengths and weaknesses, learning awarenesses and blind spots. One's profile, then, represents one's four basic styles in a descending order of access. My own profile is described for the sake of illustration only, i.e.,

Dominant—Intuitive Thinking
Auxiliary—Sensing Thinking
Tertiary—Intuitive Feeling
Inferior—Sensing Feeling

and my dominant orientation is introverted. This profile suggests that what's mostly accessible is the capacity to reason, analyze, evaluate, summarize, articulate, etc. On the auxiliary level it suggests the need to be organized, neat, on time, practical and efficient. The dominant and auxiliary functions tend to be largely in consciousness. Like one's most used hand these functions work because they are well practiced. And, they are well practiced because early in life our experimentation with these functions was approved by those significant others in our lives. Emotional "centeredness" is largely the result of having one's genetically coded functional dependencies affirmed by those we relied on for feedback on ourselves as young children.

"The self is our "life's goal, for it is the comletest expression of that fateful combination we call individuality."

"Everything living dreams of individuation, for everything strives toward wholeness, and the greatest possible actualization of the self is the aim of life."

Carl Gustav Jung

"The center of the mandala is the point of individuation, hence the energy drive is centripetal."

"In the end we have to acknowledge that the self is a complexio oppositorum precisely because there can be no reality without polarity."

Carl Gustav Jung

The tertiary and inferior functions tend to be more out of consciousness, partially or entirely depending on one's age and mental maturation. Essentially these lower two levels of one's profile represent the undeveloped capacities, or one's potential. The undeveloped functions, as a simile, are like writing with the non-preferred hand, but it is also frustrating, inefficient, labor-intensive, embarrassing, etc. A balanced personality is, in effect, the capacity to be ambidextrous. In psychological language

it means one can operate effectively and efficiently in all four positions.

One of Jung's favorite sayings was "... life is always journey, never destination." Regardless, then, of how well developed one may be, it is still a question of relative growth, i.e., the quest for individuation is life's challenge and its goal. The final frontier is the discovery of the self. The quest is life's meaning.

"They do not understand how that which differs with itself is in agreement: harmony consists of opposing tension, like that of the lyre on the bow."

Heraclitus, 500 B.C.

"Art is a lie that helps us to realize the truth."

Piccasso, 1965

Metacognitive Applications

Utilizing the brain psyche-model we have an interpretive tool to plan better instruction. As a decision-making mechanism we can know three things:

1) who we are as learners, our styles and profiles
2) who our students are, as styles and profiles, and
3) what our content/objectives/goals are as styles and profiles.

The metacognitive implications of the model are essentially those of providing the stimuli to move students from a sensory to a more intuitive and self-reflective mode of thinking.

"Meta" as a prefix means moving some thing, some idea, from one place to another. So there is meta-cognition, what we feel and think about our behavior; there is meta-knowledge, what we know, plan, remember and do in executing a repetitive or familiar task, there is metapositioning, standing above or reflecting on our various roles; there is meta-language (of which metaphor is an excellent example), i.e., the way words are used to describe what the thing or idea is like, in effect all language being metaphorical, and finally there are meta-strategies, those presentation modes that move students from

---

Definitions: Metacognitive knowledge is knowledge about knowing, including knowledge about the capabilities and limitations of human thought processes.

Nickerson, Perkins and Smith, 1985, p.101

" . . . people put up with a system because 'there are no alternatives,' and when one cannot think of anything to do one soon ceases to think at all."

Paul Goodman

"Argue for your limitations and, sure enough, they're yours."

Richard Back in Illusions

---

one psychic or style orientation to another. In effect, then, metacognitive thinking starts out as reflective but then "moves" on to be reflexive. When on thinks about one's thinking one is reflective, but when one metacognates one is reflexive. Reflexivity is one thinking about oneself thinking about oneself thinking. Reflexive or metacognitive "responding" is when the pronoun is used as an object to refer to the subject of the verb, e.g., "When I'm thinking about myself I say to myself I'm not myself," or "In thinking about the experience I was so disoriented I was beside myself," or "I'm of two minds," or "I said to myself says I," or "I heard myself saying," etc.

Gnosis, the stem word, literally means

Figure 5: Teaching for Four Thought—Cognitive and Affective Processes Associated with the Four Learning Styles

N

Curriculum Goal: Understanding Critical Thinking, Hypothesizing and Concept Development

- summarizing, classifying, comparing and contrasting
- looking for cause and effect
- inductive and divergent reasoning
- analyzing and synthesizing
- hypothesizing
- evaluating and conceptualizing
- testing and research

Curriculum Goal: Synthesis Creativity, Valuing, Problem-Solving and Aesthetic Judgment

- associative and creative thinking
- original, fluent, flexible and elaborative thinking
- reorganization and application of data
- conscious self deceit
- moral awareness
- forced associations, metaphorical thinking, personal and compressed analogies
- innovative

T — **F**

Curriculum Goal: Mastery Knowledge, Comprehension and Skill Development

- observing, describing, memorizing, translating, categorizing, drilling, listing, practicing, organizing, and mapping
- convergent and deductive thinking
- demonstrating specific skills and abilities
- attention to the pragmatic, testable and doable
- basic skills

Curriculum Goal: Involvement Self Concept, Socialization and Academic Maturity

- describing feelings
- empathizing
- effective interpersonal communication
- personal and group decision-making skills
- leadership skills
- providing and wanting support and approval
- self awareness
- "reading the vibes"

S

Figure 6: Teaching for Four Thought—Teaching, Learning and Curriculum: Putting it All Together

Intuition

NT

Goal—Understanding
Teacher's Role—present information and probe for explanations and reasons
Student's Role—think analytically, logically and provide evidence, reasons for, hypotheses/conclusions
Reinforcement—opportunities to demonstrate thinking through argument, debate and explanations
Problem-Solving Step—work the problem
Type of Literacy—cognition
Question form—why, where's your data? What's your hypotheses? How do you know this is so?
"F" Word—Formulate

NF

Goal—Synthesis
Teacher's Role—arranging for chilces; facilitating
Student's Role—reorganizing and applying information in new and different ways; generating examples
Reinforcement—accepting, challenging and designing projects
Problem-solving step—finding the problem to be answered
Type of Literacy—visual discrimination skills
Question form—What would happen if . . .? Select a metaphor for . . ., Draw a symbol for . . ., Create a project, etc.
"F" Word—Fantasy

Thinking — **Feeling**

ST

Goal— Mastery
Teacher's Role—presenting information and arranging for practice
Student's Role—recalling
Reinforcement—exercises
Problem-Solving step—problem definition and data gathering
Type of Literacy—cultural
Question form—who, what, where, when, how
"F" Word—Facts

SF

Goal—Involvement
Teacher's Role—personally relate to the content (how did you learn this material?)
Student's Role—reinventing the self
Reinforcement—student manifest personal relationship to content
Problem-solving step—selecting the problem to be worked on
Type of Literacy—of the self
Question Form—use of personal pronoun
"F" Word—Feeling

Sensing

"interpreting the shadows" as in the reading of a sundial. In effect it is the shadow which provides the data. The "shadow" notion is a powerful metaphor because it directs us continually to discover what we don't know, what's unclear, what's cloudy.

Meta-gnosis or meta-cognosis means there are parallel ways of knowing, for example, cognition and re-cognition. Something that has been previously cognized can now be recognized. Recognition is knowing as in knowing how, a transaction, something recalled from a past, whereas cognition is in the present as in learning a "what" for the purpose of transmission. Cognition, whether of thought or affect, is for the purpose of extending or sharing, or, if you will, "moving" meaning to another plain through interaction with others.

A final dimension of metacognition is the idea that our thoughts about our thoughts have the effect of changing our thoughts, for example, we'll hear ourselves say "...the more I thought about that the more I realized I couldn't agree with myself...my former conclusions...," etc. In short metacognition takes the form of a dialogue between and among the self's cognitive, affective, conscious and assumed selves. Historically, the movement to consciousness was the awareness that all one's voices were from within.

As physicists can't see atoms so we as educators can't see the processes we're examining. We must recognize how effective our practices are based upon their effects on our students. When our students are learning then we are teaching. Now the issue is before us. Why does a particular teaching work well for some but not for others? And, when I'm successful do I know why? And when I'm unsuccessful do I know why? And when I'm not do I know why? The shadows can tell us.

Some Metacognitive Principles for Learning

1. The brain is a quadrilateral performer. Effective learning occurs when the student is challenged to respond on all levels. Effective teaching requires constant and planned "shifting" from one presentation style to another. See *Shifting in Style*.

2. Learning involves the entire psyche of which the body is a part. Effective learning occurs when the student can experience appropriate kinesthetic as well as whole-body activities. Effective teaching requires a consciousness of how the body effects the mind and the planned uses of autogenic activities. See *Autogenics*.

3. Learning content that has "meaning" requires the learner's verbalization. Effective learning occurs when the student, in dyads or small groups, can verbally rehearse the problem-solving process, and/or correctly articulate the required understanding. Effective teaching requires the orchestration of multiple opportunities for students to individually articulate the content to be learned. See *Talk Thru*. See *Dyads*. See *M.E.T.A.*

4. Learning academic content requires that the brain be simultaneously relaxed yet alert. Effective learning occurs when students are consciously relaxed, have been helped in dealing with their anxieties or fears, and when learning is collaborative and team-centered. Effective teaching requires a consciousness of the determinative role of affect over cognition and that students verbalize their emotional states. See *Semrad's Steps*. See also *Autogenics*.

5. Learning for recall requires patterning. Effective learning occurs when students consciously select from a repertoire of organizational patterns. Effective teaching occurs when these patterns are role-modeled in the process of teaching the content. See *Mnemosyne's Children*.

6. Learning requires conscious self-management. Effective learning occurs when the student assumes responsibility for

mastering the required tasks. Accepting responsibility assumes an attitude of capacity, i.e., that one can, with effort, achieve the required skills or understanding. Effective teaching requires the role-modeling of "self-talk" or pep-talk procedures. Teachers orchestrate groupings and time for students to discuss their own approaches to task management. See *The Gifted Paradigm: Making Tacit Knowledge Conscious; Decision-Making; Concepts of Self Cognition.*

7. Learning requires dealing with resistance. Effective learning requires that the students address and accept as "givens" any counterproductive feelings, e.g., "I can't," "I haven't done this before," etc. and adopt an "I'll succeed" attitude. Effective teaching requires that a basic paradigm be understood, i.e., 1) thinking involves change, 2) change involves risk, 3) risk involves discomfort, and 4) discomfort results in resistance. Teachers must assume the resistance and work with it in positive ways. Teachers "reframe" the resistance such that students non-productive attitudes are perceived as natural and as productive. Teachers must invite the resistance to make it conscious and manageable. See *Reframing: Positive Connotation.*

8. Learning is its own reward. Effective learning occurs when students feel "filled" by their own learning experiences. Motivation is internal. Students "feel" enhanced personally and academically. Energy is directed to experimentation and new growth. Learning is organized around content of personal interest. Effective teaching occurs when content is presented over all the styles and by using a rich mixture of strategies and tactics. Teachers simultaneously affirm the student's strengths and interests and challenge the growth of those interests through activities in the other styles. Teachers invite students to demonstrate their growth across each of the styles. Process as well as content records, portfolios, etc. are maintained. Academic and personal growth are promoted through cooperative learning. See *Teaching Styles and Strategies, Thoughtful Education, The MindWorks! Series.*

9. Learning begins with the recognition of affect. Effective learning occurs when students can accept and work with their feelings-positive or negative. Feelings are the psyche's gift to cognition. The highest form of rationality is the ability to work with one's feelings. Effective teaching deliberately organizes an environment that invites the recognition of feeling state, relates feelings to cognition, and focuses the entire learning effort on student "self-invention." See *Bracketing; Semrad's Steps; Reframing; Process Activities; Survival Kit.*

10. Metacognitive capacity begins with self-knowing. Effective learning occurs when students have the ability to verbalize their psychological type, to discuss their assets and liabilities, and to describe the four basic personality profiles. Effective teaching requires role-modeling, affirmation, challenging, questioning and providing feedback in the four styles. See *Learning Styles and Strategies, The Leaning Preference Inventory User's Manual, Questioning Styles and Strategies, Task Rotation, Lesson Design, The TextWorks Series, Questing.*

11. Learning is for the sake of self-discovery. Effective learning occurs when the student verbalizes that the "journey" has begun, that what is being learned contributes to the process of becoming what one is. The psyche becomes a full partner in the academic learning process when the whole mind (body, mind, spirit) is engaged, when the student can verbalize what is as well as what can be, and when the student can explain how the "polarities" of existence, e.g., feeling versus thinking, sensation versus intuition, sensation versus intuition, right versus left, good versus bad, youth versus age, male versus female, love versus apathy, truth versus falsehood,

conscious versus unconscious, cognition versus metacognition, etc. contribute to becoming a whole human being. Effective teaching occurs when an environment is created that neutralizes learning styles, that makes it clear there is no right or wrong style, no better or worse form of intelligence, no better or worse form of taking the "journey" to self-discovery. The teacher role-models different paths on the journey, different ways of learning required content, and continually references his/her own stage(s) in the self invention process. See Sharp's *C.G. Jung Lexicon*; Spoto's *Jung's Typology in Perspective*; Samuels', et al, *A Critical Dictionary of Jungian Analysis*; Sharp's *Personality Types: Jung's Model of Typology*; C.G. Jung's *Memories, Dreams, Reflections*; and *Psychological Types*; and Lowen's *Dichotomies of the Mind*.

References

Adams, J. L., Conceptual Block: *A Guide to Better Ideas*, W.W. Norton, New York, 1984.

Bandler, R. and J. Grinder, *Refraining: Neuro-Linguistic Programming and the Transformation of Meaning*. Real People Press, Moab, Utah, 1982.

Bruner, J., *On Knowing: Essays for the Left Hand*. Belknap Press, Harvard University Press, Cambridge, MA, 1979.

Caine, R. and G. Caine, "Understanding a brain-based approach to learning and teaching" in Educational Leadership, Vol. 48, No. 2, October 1990, pp. 66-70.

Costa, A., et al, *Developing Minds: A Resource Book for Teaching Thinking*. A.S.C.D., Alexandria, VA, 1985.

Dewey, J. *How we think*. D.C. Heath, Boston, MA, 1933.

Eysenck, H.J., *Know Your Own IQ*. Pelican,l Baltimore, MD, 1962.

Gardner, H. Art, *Mind and Brain*. New York, Basic Books, 1982.

Gardner, H. *Frames of Mind: The Theory of Multiple Intelligences*. Basic Books, New York, 1983.

Goodman, D. "Learning from Lobotomy" in *Human Behavior*, January, 1978, pp. 44-49.

Gray, E., "Brain Hemispheres and Thinking Styles" in *The Clearinghouse*, Vol. 54, No. 3, November, 1980.

Guilford, J. P., *Intelligence, Creativity and Their Educational Implications*. Robert Knapp Publishing Company, San Diego, CA, 1968.

Hamden-Turner, C. *Maps of the Mind*. New York, Collier Books—Macmillan Company, 1981.

Hayes, J.R., *The Complete Problem-Solver*. Franklin Institute Press, Philadelphia, PA, 1981.

Jung, C.G., Psychological Types. Bollinger Series, Princeton University Press, Princeton, NJ, 1921.

Lowen, W. *Dichotomies of the Mind*. John Wiley and Sons, New York, 1982.

Mayer, R.E., *Thinking, Problem-Solving, Cognition*. W.H. Freeman, San Francisco, CA, 1983.

Meeker, M. *The Structure of Intellect: Its Interpretations and Uses*. Chas. E. Merrill, Columbus, Ohio, 1969.

Miller, L., "The Emotional Brain" in *Psychology Today*, February, 1988, pp. 34-39.

Myers, I., and M. McCaulley, *Manual: A Guide to the Development and Use of the Myers Briggs type Indicator*, Consulting Psychologist Press, Palo Alto, CA, 1985 (contains research on type and high academic performance).

Nickerson, R., Perkins, N. and E.E. Smith, *The Teaching of Thinking*. Lawrence Erlbaum Associates, Hillsdale, NJ, 1985.

Novak, J. and D.B. Gowin, *Learning How to Learn*. Cambridge University Press, New York, 1984.

Perkins, D., *The Mind's Best Work*. Harvard University Press, Cambridge, MA, 1981.

Raths, L., Jonas, A., Rothstein, A., and S. Wasserman, *Teaching for Thinking*. Chas. Merrill, Columbus, Ohio, 1967.

Restak, R. *The Brain*. Bantam Books, New York, 1984.

The Brain: A User's Manual. The Diagram Group, A Perigee Book, G.P. Putnam & Sons, New York, 1982.

Toulmin, S., Rieke, R., and A. Janik, *An Introduction to Reasoning*. Macmillan Books, New York, 1979.